

Claims

[c1] What is claimed is:

1. A television tuner comprising:
a first mixer having inputs coupled to a received RF signal for converting the received RF signal to an intermediate frequency signal;
a band-pass filter coupled to the first harmonic mixer;
a second harmonic mixer coupled to the band-pass filter for directly converting the intermediate frequency signal to an in-phase baseband signal; and
a third harmonic mixer coupled to the band-pass filter for directly converting the intermediate frequency signal to a quadrature-phase baseband signal.

[c2] 2. The television tuner of claim 1, wherein the first mixer is a harmonic mixer.

[c3] 3. The television tuner of claim 2, further comprising a first local oscillator operating at a first frequency and providing a first reference signal and a second reference signal, the second reference signal being the first reference signal phase shifted by 90 degrees.

[c4] 4. The television tuner of claim 3, wherein the first fre-

quency is determined by the frequency of the received RF signal.

- [c5] 5. The television tuner of claim 4, wherein the first frequency is variable and determined by the frequency of the received RF signal.
- [c6] 6. The television tuner of claim 3, wherein the first frequency is determined by the band-pass filter.
- [c7] 7. The television tuner of claim 3, wherein the first frequency is determined by the frequency of the received RF signal.
- [c8] 8. The television tuner of claim 7, wherein the frequency of the intermediate frequency signal is centered at the center frequency of the bandwidth of the band-pass filter.
- [c9] 9. The television tuner of claim 1, wherein the second mixer and the third mixer are harmonic mixers.
- [c10] 10. The television tuner of claim 9, further comprising a second local oscillator operating at a second frequency and providing a third reference signal, a fourth reference signal, a fifth reference signal, and a sixth reference signal, the fourth reference signal being the third reference signal phase shifted by 45 degrees, the fifth reference

signal being the third reference signal phase shifted by 90 degrees, and the sixth reference signal being the third reference signal phase shifted by 135 degrees; the second harmonic mixer having inputs coupled to the third reference signal and the fifth reference signal, and the third harmonic mixer having inputs coupled to the fourth reference signal and the sixth reference signal.

- [c11] 11. The television tuner of claim 10, wherein the second frequency is determined by the output of the band-pass filter.
- [c12] 12. The television tuner of claim 10, wherein the second frequency is fixed.
- [c13] 13. A method of processing a received RF signal, the method comprising:
 - mixing the received RF signal to produce an intermediate frequency signal;
 - filtering the intermediate frequency signal to produce a pass band signal;
 - mixing the pass band signal to produce an in-phase baseband signal; and
 - mixing the pass band signal to produce a quadrature-phase baseband signal.
- [c14] 14. The method of claim 13, wherein the received RF sig-

nal is mixed harmonically with a first reference signal and a second reference signal having a first frequency, the second reference signal being the first reference signal phase shifted by 90 degrees.

- [c15] 15. The method of claim 14, further comprising varying the first frequency according to the frequency of the received RF signal.
- [c16] 16. The method of claim 13, wherein the frequency of the intermediate frequency signal is fixed.
- [c17] 17. The method of claim 13, wherein the pass band signal is mixed harmonically with a third reference signal and a fifth reference signal to generate the in-phase baseband signal and the pass band signal is mixed harmonically with a fourth reference signal and a sixth reference signal to generate the quadrature-phase baseband signal, wherein the third reference signal, the fourth reference signal, the fifth reference signal, and the sixth reference signal are all have a second frequency, the fourth reference signal being the third reference signal phase shifted by 45 degrees, the fifth reference signal being the third reference signal phase shifted by 90 degrees, and the sixth reference signal being the third reference signal phase shifted by 135 degrees.

- [c18] 18. The method of claim 17, wherein the second frequency is determined by the frequency of the pass band signal.
- [c19] 19. The method of claim 18, wherein the second frequency is fixed.